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ABSTRACT

Fifteen Teacher Education and Computer Centers (TEC) were funded by the California State Legislature to provide staff development services to teachers and administrators in all areas of the curriculum, but especially in mathematics, science, technology, and other curriculum areas in which there are significant shortages of teachers. This paper presents an analysis of the mathematics and science staff development activities conducted by the TEC Centers. Included are discussions of (1) the dimensions of mathematics and science training; (2) the extent and nature of TEC mathematics and science training; (3) the pattern of training over the last three years; and (4) suggestions for increasing mathematics and science staff development. Sources of information included site visits, interviews, a survey of services, document analysis, and use of database records of training provided. In 1983-84 the TEC Centers provided very little training in mathematics and even less in science. Five reasons for this appear to be: lack of client demand; higher priority in other areas (computers, instructional supervision, methodology); lack of qualified trainers; lack of resources; and insufficient time to develop a plan. Six suggestions and additional comments on teacher retraining are also included. (MNS)

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Math and Science Training in California: The Response of the Teacher Education and Computer Centers

by

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INTRODUCTION

A variety of staff development programs have operated concurrently in California over the past 10 to 15 years. Three years ago the Legislature authorized and funded fifteen Teacher Education and Computer (TEC) Centers to provide staff development services to teachers and administrators. This authorization of the Teacher Education and Computer Centers (TEC Centers, or TECCs) to provide staff development services to teachers and administrators on a regional basis was codified in the Hughes-Hart Educational Reform and Finance Act of 1983 (SB 813, Chapter 498, Statutes of 1983). The TEC Centers are charged with providing staff development resources in all areas of the curriculum, in instructional use of computers, and in instructional methodology and with providing technical assistance to support school-based staff development programs. Staff development resources are required to be provided in all areas of the curriculum, but especially in math, science, technology, and other curriculum areas for which there are significant shortages of qualified, certificated teachers. The TEC Center initiative was intended to incorporate earlier staff development programs into a single statewide system. While the mission is broad and complex, the overall intent is to provide some coherence to the content and delivery of staff development while at the same time allowing for considerable regional flexibility.

The mission of the TEC Centers has been evolving over the past several years in conjunction with the educational reform movement. The original mission placed a strong emphasis on introducing technology to classroom instruction and addressing needs for more teacher proficiency in math and science. Through SB 813 and current priorities of Superintendent Honig and educators throughout California, the TEC Centers are now being urged to become

part of the overall curriculum reform effort by providing more staff development resources combining content and instructional methodology in all areas of the curriculum.

Staff development has assumed a pivotal role in the educational reform process. State policymakers have augmented overall resources for staff development and moved organizationally to expand strategies to provide for effective regionalization of staff development. Two new major regional staff development agencies were created in 1984-85--the Curriculum Implementation Centers (CICs) and the Administrator Training Centers (ATCs). The CICs were established with $1.1 million set aside from the state appropriation to the TEC Centers for the 1985 budget year. The purpose of the CICs is to stimulate the development of the highest quality staff development programs in each subject area, with the TEC Centers acting as one of the major dissemination networks for training programs developed by the CICs. The ATCs were created to address staff development needs of school administrators who have emerged as a focal point in much of the school effectiveness literature.

The overall staff development picture in California has become increasingly complex, and policymakers at all levels are currently attuned to the need for clarification of roles for the various providers. Although the TEC Centers have had a great deal of visibility as well as a very significant role in providing staff development to school personnel, county offices of education have always had a major role in providing staff development and currently have an interest in clarifying their role in relation to the newly created staff development agencies which are housed within their agencies and heavily supported administratively by them. Already underway is an effort to promote regional planning for staff development that will lead to a plan to more effectively match the strengths of the various providers to regional staff development needs.

The TEC Centers are located to reflect the general attendance areas of the California State University campuses, which results in a geographically diverse network spanning county lines. County superintendents in each designated TECC region select one of their county offices as the local education agency (LEA) to house the TECC operations. In regions where there are multiple county offices, the superintendents have the option of establishing an executive board to serve as a forum for resolving problems and reviewing policy issues.

TEC Centers operate under guidelines provided by policy boards, composed of a majority of teachers. Policy boards work with TECC staff to set service priorities and coordinate with LEAs to oversee TECC functions. Policy boards also have the responsibility, with the concurrence of the county office of education acting as the LEA, to adopt a center budget and plan and to select center staff.

The Superintendent of Public Instruction has final authority for the TEC Center program. Responsibilities of the Superintendent and SDE include designation of the TECC regions, with the advice of county superintendents; approving center plans and authorizing allocation of funds to the centers; facilitating communication among the centers; and evaluating the effectiveness of the centers. The Superintendent also has the authority to set aside money from the total TECC allocation to fund exemplary projects and support services.

TEC Center funding is based on an average daily attendance (a.d.a.) formula and, for 1984-85, included a basic operating budget ($205,000) with regional geographic adjustments. The purpose of the geographic adjustments is to give consideration to variation in travel costs. The 1984-85 statewide budget for the TECC program was $11.982 million. Of this total, $10.233 million was allocated to the centers. The remainder was reserved to support the CICs, the software clearinghouse, and a math retraining project.

In 1984-85 all 15 TEC Centers received increased funding with a mean increase in state allocations of 68.6 percent over 1983-84 levels. In addition to the state allocation, each TEC Center received additional funds to offset added costs of administering state grant programs.

Thirteen of the 15 TEC Centers allocated the largest portion of their budgets to salaries of center staff and to contracted services. All centers employ a director and support some additional professional staff. The range of full-time professional employees during 1984-85 was from 2.7 to 11.0.

Presented in this paper is an analysis of the math and science staff development activities conducted by the TEC Centers. Included are discussions of: (1) the dimensions of math and science training; (2) the extent and nature of TECC math and science training; (3) the pattern of training over the last three years, and (4) suggestions for increasing math and science staff development.

METHODS and DATA SOURCES

Sources of information for this study included site visits to most of the centers; telephone interviews; interviews with SDE and legislative staff; a survey of services provided in specific curriculum areas, and document analysis. In addition, information was obtained from a comprehensive data base in which individual centers record all training provided. Information gathered during this study was used to: (1) provide information on the status of math and science training of the TEC Centers including the number and type of services and trainings provided; (2) portray variation between the fifteen TEC Centers, and (3) describe activities of the TEC Centers in relation to other agencies, in particular, county offices of education, colleges and universities, and business and industry.

ANALYSIS and FINDINGS

In this section we analyze the math and science staff development activities conducted by the TEC Centers. Included are discussions of: (1) the dimensions of math and science training; (2) the extent and nature of TECC math and science training; (3) some explanations for the limited activity in these areas, and (4) suggestions for increasing math and science staff development.

With the TECC mandate it would be reasonable to expect a substantial amount of TECC training in math and science. What we found, however, was that in 1983-84 the TEC Centers provided very little training in math and even less in science. Even more striking is the lack of demand for training in these areas. As one TEC Center director reported to us, "Traditional staff development methods are not sufficient to attract practicing math and science teachers. Incentives are needed in the form of release time, stipends, and other creative and motivational programs if we are to truly impact the quality of math and science instruction in our schools." Later in this section we will develop some themes which lend a perspective on math and science activity, and we will suggest some potential actions for increasing TEC Center activity in math and science.

The Dimensions of Math and Science Training

There are basically three groups of secondary teachers for whom math and science staff development should be provided: the "crossover" teachers who have minimal formal training in math or science; current math and science teachers who are inadequately trained in their content area; and adequately prepared teachers who need "retooling" in their content area. Each of these groups required a different training approach varying in intensity from a half-day workshop to a year or more of structured training.

A recent study* commissioned by the San Diego TEC Center sheds some light on the scope of the shortage of qualified teachers in mathematics. From a survey of all secondary teachers in the region (the response rate was about 20 percent), Silver concludes that "In general, the data suggest that the current group of mathematics teachers in our region is drastically underqualified. Nearly 50 percent of the current teachers appear to lack the minimum qualifications for teachers of junior high school mathematics established by the National Council of Teachers of Mathematics, and almost 80 percent lack the minimum qualifications for teachers of secondary school mathematics." Shown in Table 1, from Silver's study, is rather cogent evidence that there is need for substantial improvement in content training--47 percent of the teachers responding to his survey have less than a math minor.

Table 1

Classification of a Sample of Teachers,

by Mathematics Background

(from Silver, 1983)

Mathematics background	Number of teachers (percent)	
Master's Degree	19	(8%)
Bachelor's Degree	31	(13%)
Math Minor	71	(31%)
Less than Math Minor	109	(47%)
Not Reported	1	(1%)

*Silver, Edward A. The Mathematics Teacher Shortage: An analysis of the Problem and Some Possible Solutions. A Report to the Policy Board of TEC Center for San Diego and Imperial Counties. October, 1983.

The role of the TEC Centers as providers of training in this picture is less clear. They are but one, and a rather modest (in terms of resources), contributor to the solution of a problem that requires intervention on numerous fronts. It is evident that the centers cannot provide the kind of massive retraining necessary to dramatically improve the situation. They can, however, continue in the tradition of the School Resource Centers and PDPICs and provide professional development or "retooling." (Retraining in math and science is discussed below).

Elementary teachers represent a largely untapped market for TEC Center training in math and science. The demands for content are less stringent and methodology is particularly important. While the need is overwhelming, the TEC Centers certainly can contribute meaningful staff development in math and science for elementary teachers.

The Extent and Nature of Math and Science Training

Shown in Table 2 is a statewide summary of the number of math and science workshops, the total hours of training included in the workshops, and the total number of participants who were trained by the TEC Centers. These figures were compiled from an evaluation survey.

Table 2

TEC Center Math and Science Training, 1983-84

	Math	Science
Courses	181	122
Hours	2,040	826
Participants	3,013	2,881

Between February 1983 and February 1984, the TEC Centers conducted an average of 8.5 math workshops, representing an average of 130 hours of math training. The median number of individuals participating in math training at each center was 140.

During the same period of time, the TEC Centers conducted an average of six science workshops, representing an average of 27 hours of science training. The median number of individuals participating in science training at each center was 84.

These numbers are in contrast to the large number of training workshops in the computer area. In our interviews with TEC Center directors, estimates of math workshops as a percentage of total workshops hovered around 5 percent to 10 percent of total TEC Center training; in science the figure was closer to 5 percent, or less. The TEC Center directors feel that more staff development in both math and science is needed. In response to our mail survey, 11 out of 14 directors said that there is a need for their centers to provide more staff development in math than is currently offered. All 14 directors responding to the survey said that there is a need for their centers to provide more science staff development.

Training workshops specifically identified as math or science tend to be mixtures of content and teaching methodology. To provide a sense of the nature of the math and science training, we have listed in Table 3 the titles of a statewide sample of TEC Center-sponsored activities in math and science. While this is only a surface view (and subject to interpretation, vis-a-vis content,) this list nonetheless conveys the flavor of the offerings.

Table 3

A Sample of TECC Math and Science Trainings

Selected Titles
Science Fair
Science: Curriculum Development
Math Manipulatives: Their Use in Classrooms
Science on a Shoe-String
Computers in the Math Curriculum
Learning Theory Research in Math and Science
Advances in Biology: Molecular Biology and Recombinant DNA Technology
Principles and Theories of Evolution in the Physical, Earth, and Life Sciences
Mathematics Their Way
Earthquake Preparedness: A Hands-on Workshop
Math in the Junior/Senior High School
Science Institute Follow-Up
Developing Children's Thinking through Science
Math Improvement
Math Enrichment Modules
Genetic Engineering--A Revolution in Biology

Particularly impressive is the math and science approach in one large metropolitan area TEC Center. Briefly, the TEC Center director, with the approval of the policy board, wrote requests for proposals (RFPs) to fund the development of training programs in math and science. The RFPs were distributed to the IHEs in the TEC Center service area and were designed to generate cooperative relationships, drawing on the content expertise of the IHEs and the methodology expertise of the TEC Center staff. The resulting programs are four-day workshops targeted at the regular and/or reassigned math or science teachers. In the case of the math program, the training was designed and is being run with the cooperation of the local California Math Project. University credit is given for both the math and science programs and follow-up is planned by TEC Center staff at the school site level. While the actual number of teachers trained by these two programs is not yet great, we see this as an example of what the TEC Centers do well - they assume the role of coordinator and combine resources among various institutions (TECC, county, IHEs, districts, and schools).

Agencies Conducting Math and Science Training

While the TEC Centers have been given a specific legislative charge to conduct staff development in math and science, they are but one of several interrelated agencies providing math and science support. Shown in Table 4 are the results from our mail questionnaire, in which we asked the question, "Which agencies within your region conduct staff development in math/science, and approximately what percent of the total activity does each agency conduct?" The percentage represented by the TEC Centers represents their direct contribution; however, they are often involved in the brokering of math and science services through all of the other listed agencies.

Table 4

Percent of Total Math and Science Staff

Development Activities Conducted by Various Agencies

	Staff development activities			
	Math		Science	
Agency	Percent[a]	Number[b]	Percent[a]	Number[b]
TECC	25	13	30	11
County offices of education	20	11	20	12
Districts	22	8	23	8
IHEs	18	7	5	5
Lawrence Hall of Science	26	2	--	--

[a]Percentage figures reported are medians and do not sum to 100 percent. A given percent represents the proportion of total math/science activity a particular agency conducts.

[b]"Number" refers to the number of TECCs that reported a particular agency's involvement in math/science.

Not unexpectedly, county offices of education play a predominant role in math and science training. This reflects the historical role of the counties in working with districts to provide training in the curriculum areas. Typically, county offices are staffed with curriculum experts (most counties have math specialists, but only about 20 percent currently have science specialists) who either provide training directly to districts or broker services. In contrast, the TEC Centers are typically not staffed with either math or science specialists (along with general staff development profes-

sionals, TEC Centers usually have only one specialist--in the computer area) and broker nearly all of the content training or cooperatively sponsor training, with the TEC Center providing the methodology component.

District offices also account for a fair share of math and science training. Medium to large districts are staffed in a manner similar to county offices in that they often have math and science specialists to serve the schools in their region. Again, TEC Centers are often in the role of brokering district curriculum services.

IHEs vary from region to region in their contribution to math and science training. In most areas where a California Math Project is funded, TEC Centers are cooperatively and generally actively involved with their local project. This involvement can take several forms: (1) the TEC Center advertises trainings and the California Math Project provides the trainers; (2) the TEC Center provides the computer equipment both for the summer institute and for training throughout the year; (3) the TEC Center cooperatively provides training and methodology expertise, and (4) The TEC Center provides financial support to the California Math Project. By and large, the TEC Center directors are pleased with the projects and cite them as their primary involvement with math training. Indeed, in most TECC regions the developmental work occurring in math is conducted under the joint auspices of the California Math Project and the TEC Centers.

The involvement of IHEs in science staff development is considerably less developed than in math, primarily due to the fact that as yet there is no established analog of the California Math Project. Only one TEC Center reported any significant activity with a local university, although two San Francisco Bay Area TEC Centers reported significant support from the Lawrence Hall of Science.

One of the most striking findings is the relatively low level of activity in math and science training, not only from TEC Centers but from other education agencies as well. This finding emerges against a backdrop of shortages of teachers and legislation directed to stimulate teacher training and production in these areas. The extent of the shortages varies across the 15 TEC Center regions. A preliminary study of the shortage problem conducted by the SDE reinforces the uneven nature of the shortage. The study, The Teacher Shortage in California: A Preliminary Analysis, states in part "...some areas will experience sharp declines while others will show sharp increases in 9-12 enrollments. These shifts, changes in enrollment, recently dated graduation requirements with their associated staffing needs, projected retirees and new teacher demands within subject areas, will combine to provide a complex staffing problem for secondary schools over the next ten years." The statewide picture is not yet known but the results of an SDE statewide survey of districts ("Survey of Teacher Demand and Shortage, 1983-84," March 1984) should yield estimates of teacher shortages in all curriculum areas. The results of this survey should prove useful for both the SDE and the TEC Centers in planning efforts in the coming years.

In the evaluation survey we asked directors why their centers currently are offering less math and science staff development than is needed. To account for why their centers are providing less math staff development than is needed, out of 14 directors:

- Nine cited insufficient resources.
- Five cited lack of client demand.
- Five cited higher priority in other areas.

- o Eight cited insufficient time to develop a plan for math staff development.
- o Six cited lack of qualified trainers.

To account for why their centers are providing less science staff development than is needed, out of 14 directors:

- o Twelve cited insufficient resources.
- o Nine cited lack of qualified trainers.
- o Seven cited insufficient time to develop a plan for science staff development.
- o Seven cited higher priority in other areas.
- o Five cited lack of client demand.

Based on data from a variety of sources (primarily TEC Center director interviews and survey results), there appear to be several somewhat interrelated reasons that the TEC Centers are providing less staff development in math and science than is needed:

1. Lack of client demand. As we mentioned earlier in this section, teachers are not rushing to be trained in either math or science. Elementary teachers are generally not strong in math and science and often avoid additional training. Secondary teachers, on the other hand, tend to identify with their specialties, are relatively uninterested in teaching methodology, and look to their professional organizations (in science, to the National Science Foundation) for content training. Two comments from our survey best express the lack of demand: "Although this area received highest rating from district administrators in our most recent needs survey, very few teachers come to programs offered by TECC and counties;" and "Data would indicate a

need for additional inservice; however, teachers are not responding in significant numbers. The need may be apparent, but the motivation for people to attend is not."

2. Higher priority in other areas. TEC Centers are besieged with requests for training in computers, instructional supervision, and methodology which easily occupy their somewhat limited staff. It is natural for the TEC Centers to do what's in high demand (i.e., computers), what they do well, and what is widely perceived as their only mission. The demand for computer staff development is, in the short run, inexhaustible--what time is left for other areas of staff development is a function of the strength of the individual TEC Center, which is typically not math and science.

3. Lack of qualified trainers. Although a problem for both math and science, it is particularly acute in science. In math there is the support of the California Math Project and a limited training cadre in math who can instruct across a broad spectrum of the discipline. In science there is no support analogous to the California Math Project; and science training, as such, is not offered. There are few trained specialists available to offer staff development in the many disciplines of science such as physics, chemistry, and biology.

4. Lack of resources. Reasons 2 and 3 are clearly subsets of this reason. Comments from two directors highlight the need: "The expectation that a certified staff of approximately four FTE can serve the staff development needs of educators in 11 counties with an a.d.a. of 240,000 pupils in teaching methodologies, supervision skills, computer use, math and science is somewhat unrealistic. More

resources are necessary to adequately meet the staff development needs of so many in such a large and diverse region;" and "Some TECCs are located in county offices that have specialists in math/science. This TECC has no such resource and must rely on internal staff or on district/school staff members."

5. Insufficient time to develop a plan. Some TEC Centers, in this second year of operation, are beginning to develop plans for math and science training. One TEC Center director commented, echoing the theme developed above, "A written science staff development plan has just been completed. A math staff development plan must now be done. Higher priority has been given to computer literacy simply because of the overwhelming number of teachers who have requested it." Eight of the TEC Center directors reported to us that they have not yet developed a training plan for math and science. Another TEC Center director added, "Math and science needs an in-depth, well thought out plan with follow-up."

Suggestions for Increasing Math and Science Staff Development

There is no simple solution to the math and science training problem. It is a complex situation whose boundaries are not well defined and no single act is likely to significantly alter the picture. We believe, however, that good, solid incremental improvements are possible by instigating change on a number of fronts. Our recommendations emanate from our belief that the TEC Centers can serve as one "umbrella" agency for math and science training (at least the "retooling" portion). It is especially important that any TEC Center action should be coupled with a program of incentives to districts and schools to create a professional climate of expectations for teachers in math and science.

Following are actions that the TEC Centers and the SDE could follow and which we believe would enable the TEC centers to provide additional training in math and science:

1. Use some of the increased allocation from the 1984-85 Budget Act to hire math and science specialists in each TEC Center. These specialists would be in a unique position to provide direct services; broker training; coordinate with schools, districts, counties, and the state, and work cooperatively with other TEC Center personnel to provide quality staff development.
2. Coordinate the development of a "training-of-trainers" model backed by sufficient state resources, support, and interest.
3. Establish statewide clearinghouses or special centers for math and science. The purposes of the clearinghouses would be: (a) to provide a centralized resource for exemplary math and science staff development projects; and (b) to house a collection of math and science curricular materials.
4. Continue to create leverage for the TEC Centers to work with districts, IHEs, and business and industry. An example of an area where agencies are mandated to work with the TEC Centers is the California Math Project.
5. The SDE, through the Staff Development Unit (SDU) and the Office of Mathematics, Sciences, Technology, and Professional Development, should play a stronger leadership role. Probably the most important areas involve working with the TEC Centers in the development of a strategic plan for math and science training and coordinating statewide training needs with local needs. The SDE could also provide

regional training sessions for TEC Center personnel in areas such as current legislation; linkage to state level resources such as curriculum frameworks; specialized math and science content topics; in-service training models that will work in different types of districts; and so on.

6. Provide a variety of incentives for districts and teachers to encourage staff development in math and science. Since, as one TEC Center director reported to us, "many districts do not allow release time for intensive staff development in math and science," ways need to be found to strongly encourage or reward districts and teachers who participate in training.

Changing Directions: What we have seen over the course of the past year is a greatly increased effort on the part of the TEC Centers in curriculum. This effort reflects the responsiveness of the centers to Superintendent Honig and the SDE, to the charges of SB 813, and to the overall needs of LEAs. There have been some changes in TECC staffing patterns to reflect the greater emphasis on curriculum. This year has also included the birth of the CICs and increasing cooperative efforts with county office curriculum staffs in developing and delivering training in curriculum areas.

A year ago the TEC Centers got the message very clearly from the state level that they were to increase their activity in curriculum offerings. They have responded to this direction with an accelerating effort over the course of the year. It appears in the early part of 1985-86 that the trend of greater involvement in curriculum training is continuing. Tables 5-10 summarize the increased involvement in math and science in 1984-85.

Table 5

MATHEMATICS TRAINING, 1984-85

The TEC Centers statewide:

- Provided 416 math-related workshops. Of those,
  - 51% had a primary focus on math
  - 47% were computer-related
- Provided 3,921 hours of math-related training
- Trained 12,775 participants. Those participants included:
  - 86% teachers
  - 10% administrators
  - 4% classified
- Trained participants whose affiliations were:
  - 55% elementary school
  - 23% middle or junior high school
  - 22% senior high school

Table 6

VARIATION AMONG TEC CENTERS IN TRAINING DEVOTED PRIMARILY TO MATHEMATICS

- Number of math workshops during 1984-85
  - 3 TECCs provided more than 15
  - 11 TECCs provided 1 to 15
  - 1 TECC provided none
- Number of persons trained during 1984-85
  - 7 TECCs trained more than 100
  - 7 TECCs trained 1-100
  - 1 TECC trained none
- Total hours of math training during 1984-85
  - 9 TECCs provided more than 80
  - 5 TECCs provided 1-80 hours
  - 1 TECC provided none

Table 7

MATH: VARIATION AMONG CENTERS IN DEDICATED STAFFING AND ACTIVITY

- Number of TECC staff dedicated to math:
  - greater than .5 FTE ..... 4 TECCs
  - up to .5 FTE ..... 2 TECCs
  - none ..... 9 TECCs
- Amount of math staff development in 1984-85 compared to 1983-84:
  - more ..... 12 TECCs
  - less ..... 1 TECC
  - same ..... 2 TECCs
- Fourteen out of fifteen TECC directors feel there is a need to provide more math staff development than they are currently providing.

Table 8

SCIENCE TRAINING, 1984-85

The TEC Centers statewide:

- Provided 314 science-related workshops. Of those,
  - 54% had a primary focus on science
  - 34% were computer-related
- Provided 3,201 hours of science-related training
- Trained 13,013 participants. Those participants included:
  - 90% teachers
  - 8% administrators
  - 2% classified
- Trained participants whose affiliations were:
  - 71% elementary
  - 16% middle or junior high
  - 13% senior high

Table 9

VARIATION AMONG TEC CENTERS IN TRAINING DEVOTED PRIMARILY TO SCIENCE

- Number of science workshops during 1984-85
  - 5 TECC's provided more than 15
  - 9 TECCs provided 1-15
  - 1 TECC provided none
- Number of persons trained during 1984-85
  - 11 TECCs trained more than 100
  - 3 TECCs trained 1-100
  - 1 TECC trained none
- Total hours of science training during 1984-85
  - 6 TECCs provided more than 80
  - 8 TECCs provided 1-80
  - 1 TECC provided none

Table 10

SCIENCE: VARIATION AMONG CENTERS IN DEDICATED STAFFING AND ACTIVITY

- Number of TECC staff dedicated to science:
  - greater than .5 FTE ..... 5 TECCs
  - up to .5 FTE ..... 1 TECC
  - none ..... 5 TECCs
- Amount of science staff development in 1984-85 compared to 1983-84:
  - more ..... 12 TECCs
  - less ..... 1 TECC
  - same ..... 2 TECCs
- Fourteen out of fifteen TECC directors feel there is a need to provide more science staff development than they are currently providing.

Teacher Retraining

The retraining of teachers is a statewide problem of immense, although not clearly defined, proportions requiring action throughout all levels of the educational system. There is a need for a well-defined, well-funded, multiple-level, coordinated effort among key agencies, including the Legislature, the State Department of Education, the Commission for Teacher Credentialing, institutes of higher education, counties, districts and schools, teacher organizations, the TEC Centers, and others. To provide some perspective on the role of the TEC Centers in retraining, consider that in 1982-83 a state grant of $480,000 was made to the Los Angeles County Office of Education (coordinated through the L.A. TEC Center) to administer the Math Retraining Project with regional colleges and universities (subsequently reallocated in 1983-84 at $508,000 for math and science retraining). While the program trained approximately 140 teachers for one year, this was (and remains) the only formal retraining program involving the TEC Center system. This retraining program was specifically targeted for Los Angeles where there are large numbers of math and science teachers who are teaching under emergency authorizations.

The TEC Centers are moderately staffed (approximately 4 FTEs per center) and well situated to provide professional staff development services in curriculum, instructional supervision, school management, and computer use. Given their mission, level of resources, and overwhelming demand for services in some areas, it may be unrealistic to expect a meaningful contribution in the area of teacher retraining. In other words, the TEC Centers are currently not constituted in such a way as to intervene significantly in the retraining area.

The TEC Centers, however, can and do play a role in the professional development or "retooling" of currently qualified teachers. With the education

reform movement underway and the reform and the persistent and often dramatic impact of technology on all phases of the curriculum, even the most qualified teachers can benefit from periodic updates in both content and pedagogy.

We did not, as part of this study, look closely into the Math and Science Retraining Program. The SDE's Staff Development Unit, however, has summarized the program's operation during 1982-83 and what follows is the presentation of its analysis. We note that the problem areas which are presented in the analysis are addressed in the Request for Proposals for the 1984-86 Math and Science Teacher Retraining Program.

In 1982-83, the Math Retraining Project funded four college and university programs in the Los Angeles area to train approximately 200 teachers with varied mathematics backgrounds and in need of differing mathematics training and credentials. The program was designed to provide: (1) math content courses sufficient for teachers to pass the National Teacher Examination in mathematics to partially qualify for an additional authorization or math content courses and unit credits necessary for teachers to qualify for a supplemental authorization in math; and (2) math methodology courses or workshops within a supportive environment for teachers.

Data from the formative evaluation of the program indicate that approximately 140 of the 200 initial participants completed the first year of training (an attrition rate of 30 percent). These persons were selected from the pool of 800 applicants on the basis of their current credentials, the urgency of their need, and their math backgrounds. Approximately 50 percent were working toward the supplementary authorization and the other 50 percent were seeking an additional authorization. The relatively high attrition rate was purportively due to the speed and demands of the program, the lack of systematic credential counseling, and the inattention of modeling appropriate methodologies for this participant group.

Costs at public and private institutions varied, but the average cost per participant was $3,930, with tuition, fees, and materials being paid by the grant.

Feedback from participants and the training institutions collected by the Los Angeles County TEC Center as part of a formative evaluation indicated five major concerns:

1. Teachers need a refresher mathematics course before entering the prescribed math course.
2. The required math courses necessary for credentialing are too extensive to be completed by participants in one year.
3. College/university mathematics methods courses do not currently emphasize effective teaching methods related to mathematics teaching.
4. A one-year training model does not allow adequate time for training in mathematics methods.
5. Instructional methodologies appropriate for K-12 mathematics instruction need to be modeled by college/university instructors.